
A New Species of *Corallorhiza* (Orchidaceae) from West Virginia, U.S.A.

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ABSTRACT. *Corallorhiza bentleyi* Freudenstein is described from West Virginia, U.S.A. The species is cleistogamous and is currently known from only one population. It is most similar to *C. striata* Lindley, specifically variety *involuta* (Greenman) Freudenstein from southern Mexico, particularly in the structure of the labellum and size of the flower.

Corallorhiza Gagnebin comprises 11 species (including the one herein) of temperate-montane leafless orchids (Freudenstein, 1997). The genus is limited to the New World, except for *C. trifida* Chatelain, which is circumboreal. The centers of diversity are southern Mexico and the northeastern United States and Canada. The present taxon is currently known from only a single population but should be sought elsewhere in the region; given its cleistogamous nature, plants could be dismissed easily as individuals of the much more common *C. maculata* (Rafinesque) Rafinesque in bud.

***Corallorhiza bentleyi* Freudenstein, sp. nov.**

TYPE: U.S.A. West Virginia: Monroe Co., ca. 43 km NW of Roanoke, Virginia, 18 July 1998, *Freudenstein 2550* (holotype, AMES). Figure 1.

Species *Corallorhizae striatae* var. *involutae* (Greenman) Freudenstein maxime similis, sed callo ampliore labelli et floribus cleistogamis differt.

Plants to ca. 20 cm tall, reddish to yellow, with up to 20 flowers. Leaves reduced to sheaths. Rhizomes coralloid, roots absent. Flowers closed, perianth connivent, perianth segments 3-veined, those other than the labellum with very faint darker reddish striping, sometimes with yellowish perianth and reddish ovary and rachis. Dorsal sepal lanceolate, 5.9–6.1 mm long, 2.1–2.5 mm wide. Lateral sepals lanceolate, somewhat falcate, strongly cymbiform, 5.5–6.1 mm long, 2.1–2.5 mm wide. Lateral petals narrowly ovate, weakly cymbiform, acute, 5.0–5.8 mm long, 2.2–3.0 mm wide. Labellum unlobed, ovate, acute, with prominent, thickened, involute margin, 4.9–5.7 mm long, 3.1–3.5 mm wide and with

slightly upturned apex; callus formed from two fused lamellae at the base of labellum, ca. 1/2 as long as the labellum, 2.5–2.8 mm long, 1.5–1.8 mm wide. Column curved forward, 3.0–3.8 mm long, 0.8–1.0 mm wide, with a small depression adaxially at its base. Rostellum triangular. Pedicellate ovary narrowly obovoid, 6.0–9.0 mm long, 2.5–3.0 mm diam., without adaxial mentum at summit.

Etymology. The species is named for Stanley Bentley, of southwestern Virginia, who discovered and first recognized the distinctness of this population.

This unusual *Corallorhiza* is known from a single population in an area ca. 4 m × 4 m on an abandoned revegetated railroad grade, with neither tracks nor ties present, in Appalachian deciduous forest of *Acer pensylvanicum* L., *Liriodendron tulipifera* L., *Quercus*, and *Rhododendron*. The population has increased in number since it was discovered in 1996. Four plants in fruit were noted that year, with eight stems in 1997, 20 in 1998, and 27 in 1999 (S. Bentley, pers. comm.). Although individuals of *Corallorhiza* are often clonal, the variation in color seen in this population suggests that more than one clone is present. Searches in the immediate area have not yet uncovered additional individuals. Neither were specimens detected in a monographic study of the genus (Freudenstein, 1997) or in a recent search of material at WVA. However, it seems likely that other individuals may exist, since the site was an active railroad earlier in the 20th century, and the plant could almost certainly not have been growing at its present location at that time.

The species is clearly most similar to *Corallorhiza striata* Lindley, which is the only other species to have an unlobed labellum with involute margins, fused lamellae at the base of the labellum, and the absence of a small spur (often called a "mentum") at the summit of the ovary. *Corallorhiza striata* is a morphologically variable species that has a wide distribution across North America. The population of *C. striata* nearest to the West Virginia

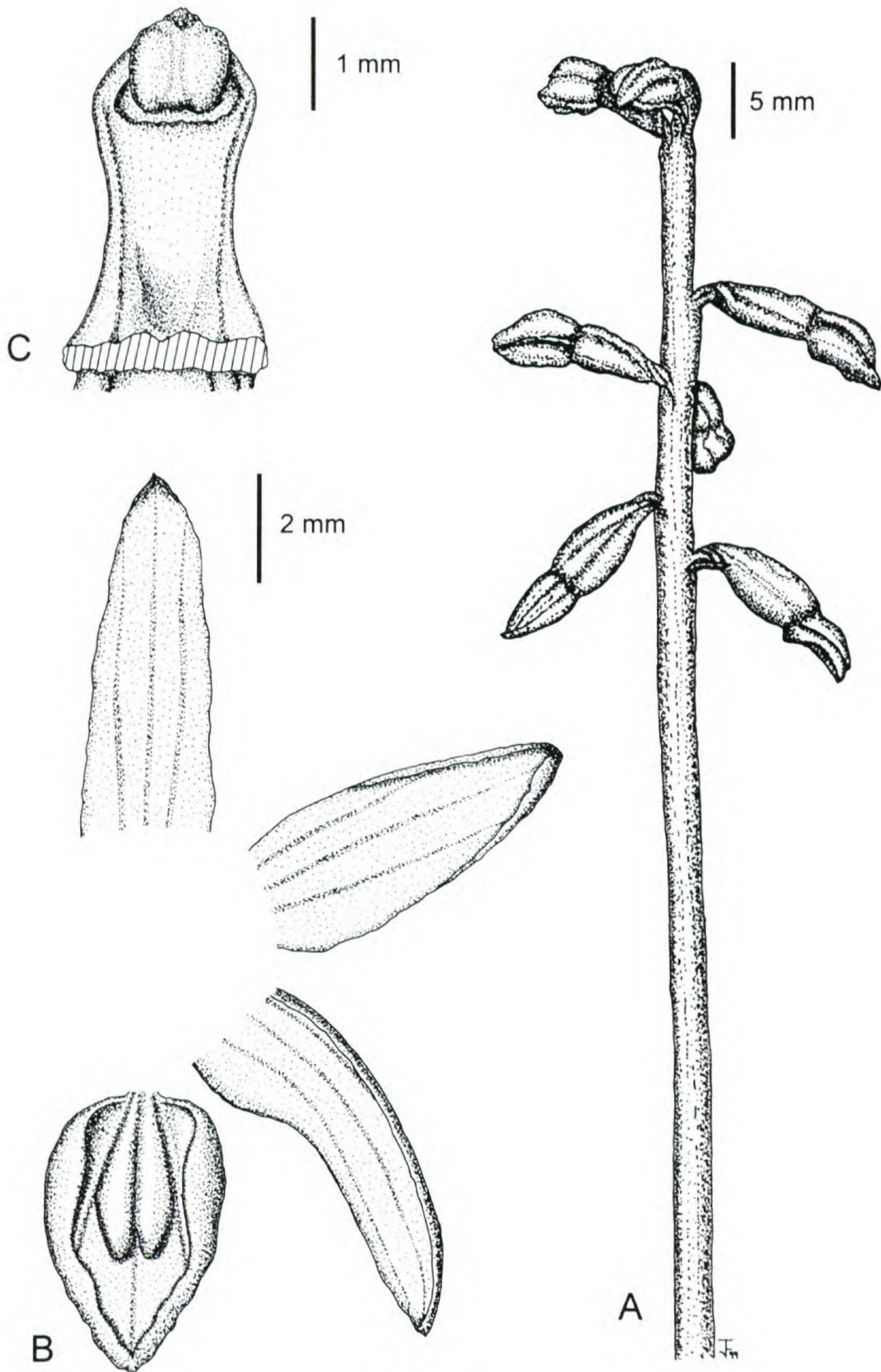


Figure 1. *Corallorhiza bentleyi* Freudenstein. —A. Habit. —B. Perianth, dissected. —C. Column, ventral view. Drawn by the author from a photograph and spirit material collected at the type locality.

locality is in central New York, where the species is very rare. However, the flowers of *C. bentleyi* differ strikingly in size from northern North American *C. striata*, being only one-half to one-third their size. Remarkably, *Corallorhiza bentleyi* is most similar to the small Mexican forms of *C. striata* that have been called *C. involuta* Greenman, but were most recently recognized as *C. striata* var. *involuta* (Greenman) Freudenstein (Freudenstein,

1997) because of the essentially continuous cline of decreasing flower size from northeastern North America southwestward to southern Mexico. The taxa differ in the proportions of the fused lamellae at the labellum base, being ca. half the length of the labellum in *C. bentleyi* and ca. one-quarter the length in *C. striata* var. *involuta*.

Corallorhiza bentleyi and northern *C. striata* also differ in flowering phenology. *Corallorhiza striata* is

an early-flowering species; in northern Michigan, where the plant can be locally frequent, it is typically in flower during the first week in June. *Corallorhiza bentleyi* flowers much later, during mid to late July. In montane regions of Mexico, *C. striata* var. *involuta* is also in flower during mid to late July.

The other clear difference between *C. bentleyi* and *C. striata* var. *involuta* is that the flowers in the former are cleistogamous. *Corallorhiza striata* varies in the degree to which the perianth expands, with the northeastern plants often having widely expanded flowers that are at least sometimes insect-pollinated (Freudenstein, 1997), while flowers of southwestern and Mexican populations tend to be less widely opened, but no truly cleistogamous flowers have been reported previously in this species. Many instances are known of species in which both chasmogamous and cleistogamous flowers are produced on the same plant, including *Viola* spp. (Russell, 1965), *Ajuga iva* (L.) Schreber (Ruiz De Clavijo, 1997), *Lamium amplexicaule* L., and *Impatiens pallida* Nuttall (Stewart, 1994; see Uphof, 1938, and Lord, 1981, for reviews). Perhaps less common are species with two types of individuals, each producing only cleistogamous or chasmogamous flowers. These have sometimes been given taxonomic standing (Uphof, 1938). Among orchids, a peloric cleistogamous form is known from Mexico in *Corallorhiza odontorhiza* (Willdenow) Poiret as variety *pringlei* (Greenman) Freudenstein forma *radia* Freudenstein, and a more widespread, primarily cleistogamous variety is also known in that species (var. *odontorhiza*; Catling, 1983; Freudenstein, 1997). Some populations of *Nervilia gassneri* B. Pettersson are cleistogamous (Pettersson, 1989, 1990). A number of instances of wholly cleistogamous species are also known ("complete cleistogamy" of Uphof, 1938). Recently described species from Orchidaceae include *Cheirostylis notialis* D. L. Jones, a cleistogamous or nearly cleistogamous species (Jones, 1997), and *Epipactis futakii* Mered'a & Potucek (Mered'a & Potucek, 1998).

Although cleistogamy is rare, autogamy is known in many temperate orchid species and is accomplished in different ways (Catling, 1983). The flowers of most *Corallorhiza* have a distinct pollinium stalk derived from the rostellum (a hamulus; Freudenstein, 1994). In *C. striata* the hamulus is well developed and functions in insect pollination. Cleistogamous forms of *C. odontorhiza* have essentially no hamulus (Catling, 1983; Freudenstein, 1994). *Corallorhiza bentleyi* does have a hamulus, but since the flowers do not open it is not utilized; the pollinia germinate in situ and grow down to the stigma on either side of the rostellum.

The cleistogamous nature of *C. bentleyi* could be a clue as to its origin. Two possibilities exist: either it was dispersed by chance from Mexico to West Virginia, or it is a relictual population of a taxon with a formerly more extensive distribution. The chances of an orchid seed being transported this distance and finding the appropriate fungus with which to interact seem remote. Since there are no currently known cleistogamous populations of *C. striata* in Mexico, the evolution of cleistogamy would probably have occurred after dispersal, arguing against a recent dispersal. The relict hypothesis seems more likely, since it is easier to conceive of a formerly more extensive distribution that has contracted with changing environmental and perhaps pollinator conditions. The absence of a pollinator would have favored any tendencies toward autogamy and cleistogamy, and it is perhaps simply fortuitous that the current population has survived.

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